

CLAIMS

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is as follows:

- 1 1. A method for making prioritized recommendations to a customer in the
2 process of filling a market basket for purchase on an Internet commerce site,
3 the method comprising the steps of:
4 generating a matrix of training data;
5 considering preferences based on associative and renewal buying
6 history from the training data; and
7 making a prioritized recommendation of items so as to maximize the
8 likelihood that the customer will add to the market basket those items with
9 higher priorities.
- 1 2. The method of claim 1, wherein the two preferences are estimated
2 separately from the training data and combined in proper proportions to obtain
3 an overall preference for item not yet in the market basket.
- 1 3. A method for making prioritized recommendations to a customer in the
2 process of filling a market basket for purchase on an Internet commerce site,
3 the method comprising the steps of:
4 collecting statistics from training data;
5 precomputing model parameters from the collected statistics; and
6 recommending ordering for a given partial market basket based on the
7 precomputed model parameters.
- 1 4. The method of claim 3, wherein the step of collecting statistics comprises
2 the steps of:

- 3 (a) for each item j , obtaining n_j a number of baskets with item j purchased;
 4 (b) for each item j , obtaining n_j' a number of baskets with j being a sole
 5 item purchased;
 6 (c) for each pair of items i and j , obtaining a number of market baskets n_{ji}
 7 with items j and i purchased together; and
 8 (d) for each pair of items i and j , obtaining a number of market baskets
 9 n_{ji}' with items i and j being the only two items purchased.

- 1 5. The method of claim 4, wherein the step of precomputing model parameters
 2 comprises the steps of:

3 (a) computing $\mathbf{P}(\text{renewal}) = \frac{\sum_k n_k'}{\sum_k n_k}$;

4 (b) for each item j , computing $\mathbf{P}(j) = \frac{n_j}{\sum_k n_k}$;

5 (c) for each item j ,
 6 computing $\mathbf{P}(\text{renewal} | j) = \frac{n_j'}{n_j} + \mathbf{P}(\text{renewal}) \left(1 - \frac{n_j'}{n_j} \right)$;

7 (d) for each item j , computing
 8 $\mathbf{P}'(j | \text{renewal}) = \mathbf{P}(\text{renewal} | j) \times \frac{\mathbf{P}(j)}{\mathbf{P}(\text{renewal})}$;

9 (e) for each pair of items i and j with $n_{ij} \neq 0$, computing

$$10 \quad \mathbf{P}(j \mid i) = \frac{n_{ji}}{\sum_k n_{ki}} ;$$

11 (f) for each pair of items i and j with $n_{ij} \neq 0$, computing

$$12 \quad \mathbf{P}(\text{renewal} \mid j, i) = \frac{n'_{ji}}{n_{ji}} + \mathbf{P}(\text{renewal}) \left(1 - \frac{n'_{ji}}{n_{ji}} \right) ; \text{ and}$$

13 (g) for each pair of items \bar{i} and j with $n_{ij} \neq 0$, computing

$$14 \quad \mathbf{P}'(j \mid \text{asso}, i) = \mathbf{P}(j \mid i) \times \frac{(1 - \mathbf{P}(\text{renewal} \mid j, i))}{(1 - \mathbf{P}(\text{renewal} \mid i))} .$$

1 6. The method of claim 5, wherein given a partial basket $\mathbf{B} = \{i_1, i_2, \dots, i_k\}$
 2 and $\bar{\mathbf{B}}$ is a complementary set of items not in \mathbf{B} , the step of recommending
 3 ordering for a given partial market basket comprises the steps of:

4 (a) if \mathbf{B} is empty, sorting items in order of decreasing $\mathbf{P}(j \mid \text{renewal})$ and
 5 returning this as an item preference ordering;

6 (b) if \mathbf{B} is non-empty, then

7 (i) computing $\mathbf{P}(\text{renewal} \mid \mathbf{B}) = \min_{i_k \in \mathbf{B}} \mathbf{P}(\text{renewal} \mid i_k) ;$

8 (ii) compute a normalization factor $\sum_{k \in \bar{\mathbf{B}}} \mathbf{P}'(k \mid \text{renewal}) ;$

9 (iii) for each item $j \in \bar{\mathbf{B}}$, computing

$$10 \quad \mathbf{P}(j \mid \text{renewal}) = \frac{\mathbf{P}'(j \mid \text{renewal})}{\sum_{k \in \bar{\mathbf{B}}} \mathbf{P}'(k \mid \text{renewal})} ;$$

- 11 (iv) computing a normalization factor $\sum_{k \in \bar{\mathbf{B}}} \mathbf{P}'(j \mid \text{asso}, \mathbf{B})$;
- 12 (v) for each item $j \in \bar{\mathbf{B}}$, computing
- 13 $\mathbf{P}'(j \mid \text{asso}, \mathbf{B}) = \max_{i_k \in \mathbf{B}} \mathbf{P}(j \mid \text{asso}, i_k)$;
- 14 (vi) for each item $j \in \bar{\mathbf{B}}$, computing
- 15 $\mathbf{P}(j \mid \text{asso}, \mathbf{B}) = \frac{\mathbf{P}'(j \mid \text{asso}, \mathbf{B})}{\sum_{k \in \bar{\mathbf{B}}} \mathbf{P}'(k \mid \text{asso}, \mathbf{B})}$;
- 16 (vii) for each item $j \in \bar{\mathbf{B}}$, computing
- 17 $\mathbf{P}(j \mid \mathbf{B}) = \mathbf{P}(j \mid \text{asso}, \mathbf{B})\mathbf{P}(\text{asso} \mid \mathbf{B}) + \mathbf{P}(j \mid \text{renewal}, \mathbf{B})\mathbf{P}(\text{renewal} \mid \mathbf{B})$;
- 18 and
- 19 (viii) sorting items in order of decreasing $\mathbf{P}(j \mid \mathbf{B})$ and returning this
- 20 as an item preference ordering.

1 7. The method of claim 6, wherein the step of sorting comprises the step of
 2 using a final probability obtained for each item, $\mathbf{P}(j \mid \mathbf{B})$, of a customer buying
 3 the item to maximize profit by recommendation.

1 8. The method of claim 7, wherein the step of using a final probability of an
 2 item to maximize profit comprises the steps of:
 3 assigning a profit amount, $\$_j$, to each item;
 4 computing $\mathbf{P}(j \mid \mathbf{B})\$_j$ for each item; and
 5 ranking recommendations based on the computation of $\mathbf{P}(j \mid \mathbf{B})\$_j$ for
 6 each item.